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| 10/599,539      | 08/09/2007  | Shuichi Fujii        | 81872.0127          | 1506             |

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| EXAMINER |
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BOURKE, ALLISON

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| ART UNIT | PAPER NUMBER |
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1725

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| NOTIFICATION DATE | DELIVERY MODE |
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10/21/2011

ELECTRONIC

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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|------------------------------|--------------------------------------|-------------------------------------|--|
| <b>Office Action Summary</b> | <b>Application No.</b><br>10/599,539 | <b>Applicant(s)</b><br>FUJII ET AL. |  |
|                              | <b>Examiner</b><br>ALLISON BOURKE    | <b>Art Unit</b><br>1725             |  |

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 15 August 2011.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on \_\_\_\_; the restriction requirement and election have been incorporated into this action.
- 4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 5) ☒ Claim(s) 1-3, 5, 6, 8-10, 13, 14 and 17-26 is/are pending in the application.
- 5a) Of the above claim(s) 14 and 17-20 is/are withdrawn from consideration.
- 6) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 7) ☒ Claim(s) 1-3, 5-6, 8-10, 13, 21-26 is/are rejected.
- 8) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 9) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 10) ☐ The specification is objected to by the Examiner.
- 11) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 12) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |   |   |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948)   | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date <u>3/30/2011, 8/12/2011</u> . | 6) <input type="checkbox"/> Other: ____.  |

## **DETAILED ACTION**

### ***Response to Amendment***

1. The amendment filed August 15, 2011 does not place the application in condition for allowance.

### ***Remarks***

2. Claims 1-3, 5-6, 8-10, 13-14, 17-26 are pending in the application, while claims 14, 17-20 are withdrawn.

### ***Claim Rejections - 35 USC § 112***

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claim 26 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 26 recites the limitation "the center of the substrate" and "the center line of the electrodes" and "the center lines of the areas". There is insufficient antecedent basis for this limitation in the claim and it is unclear what these terms are referring to.

### ***Claim Rejections - 35 USC § 103***

5. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.
6. Claims 1-3, 5-6, 8-10, 13, 21-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fujii et al. (US 2003/0178057) in view of Hanoka et al. (US 5476553) and Fukawa et al. (US 2004/0200522).

Regarding claims 1, 3, 5-6, 8, 10, 13, 21-26, Fujii discloses Fujii discloses a solar cell (Fig. 1) with a surface electrode (4) on an opposite conductivity-type diffusion layer (1a) part of the semiconductor substrate having a sheet resistance of  $60\Omega/\square$ - $300\Omega/\square$  [0027] and a back surface electrode (3) that is the an identical arrangement to the surface electrode on the light receiving side (Fig. 7). Fujii additionally discloses the substrate having microscopic protrusions and recesses on the surface of the semiconductor substrate so as to introduce as much light incident on the solar cell as possible into the semiconductor substrate, and to trap as much light introduced into the semiconductor substrate as possible within the semiconductor substrate [0007]. Fujii also discloses the protrusions having widths and heights of  $2\text{ }\mu\text{m}$  or less [0057] and an aspect ratio of 0.1-2 [0058] in order to shorten time of manufacturing [0057], optimize the reflectance and the susceptibility to being damaged during manufacturing [0058].

Fujii is silent to the type of surface electrode.

Hanoka discloses the surface electrode is generally in form of a grid comprising a plurality of fingers and bus bars (Fig. 2, 32, 30) wherein all the plurality of finger electrodes are directly connected to all of the surface bus bar electrodes in a symmetrical structure (Fig. 2) and the number and the widths of the bus bars and fingers are selected so that the area of the front surface exposed to solar radiation is maximized, while at the same time the surface electrode permit recovery of electricity from the cells (C1/L36-56), but does not explicitly disclose three bus bars and the widths of each bus bar and finger electrode.

It would have been obvious to one having ordinary skill in the art to use the surface electrodes of Hanoka, in the device of Fujii, in order to permit recovery of electricity from the cells, and because it would amount to nothing more than a use of a known surface electrode structure for its intended use in a known environment to accomplish entirely expected result.

Also, as the amount of incident light and electrical output ability of the electrodes are variables that can be modified, among others, by adjusting the number of bus bar electrodes, with said incident light decreasing and electrical output increasing as the number of bus bar electrodes are increased, the precise finger electrode width would have been considered a result effective variable by one having ordinary skill in the art at the time the invention was made. As such, without showing unexpected results, the claimed three bus bar electrodes cannot be considered critical. Accordingly, one of ordinary skill in the art at the time the invention was made would have optimized, by routine experimentation, the number of bus bars in the apparatus of modified Fujii to obtain the desired balance between the amount of incident light and the electrical output of the electrodes to efficiently collect the electric current (*In re Boesch*, 617 F.2d. 272, 205 USPQ 215 (CCPA 1980)), since it has been held that where the general conditions of the claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. (*In re Aller*, 105 USPQ 223).

Additionally, as the amount of incident light and electrical output ability of the electrodes are variables that can be modified, among others, by adjusting the bus bar and finger electrode width, with said incident light increasing and

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electrical output decreasing as the bus bar and finger electrode width is decrease, the precise bus bar and finger electrode width would have been considered a result effective variable by one having ordinary skill in the art at the time the invention was made. As such, without showing unexpected results, the claimed bus bar and finger electrode width cannot be considered critical.

Accordingly, one of ordinary skill in the art at the time the invention was made would have optimized, by routine experimentation, the bus bar and finger electrode width in the apparatus of modified Fujii to obtain the desired balance between the amount of incident light and the electrical output of the electrodes to efficiently collect the electric current (*In re Boesch*, 617 F.2d. 272, 205 USPQ 215 (CCPA 1980)), since it has been held that where the general conditions of the claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. (*In re Aller*, 105 USPQ 223).

Additionally, modified Fujii does not disclose a plurality of solar cells and show how they are interconnected to form a solar cell module.

Fukawa discloses multiple solar cells are connected in series and parallel in order to form a module that can produce a practical amount of electrical power [0013] and additionally discloses means for connecting the cells including connection tabs (17, Fig. 1-5), which covers and connects each of the top and bottom bus bars of adjacent cells (Fig. 1-5).

It would have been obvious to one having ordinary skill in the art at the time of the invention to connect the solar cells of modified Fujii, as taught by

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Fukawa, in order to form a module that can produce a practical amount of electrical power.

Regarding claim 2, modified Fujii discloses all the claim limitations as set forth above and Fujii additionally discloses the solar cell elements each have a rectangular shape whose one side is not less than 100 mm and not more than 350 mm in length, and another side is not less than 100 mm and not more than 350 mm in length [0069].

Regarding claim 9, modified Fujii discloses all of the claim limitations as set forth above, but does not explicitly disclose the area of the contact surface between the finger electrodes and the semiconductor region is represented by  $S_1$ , an average value of distances between the edge lines of the contact surface within each cut surface formed by cutting at a plurality of cut planes that are generally perpendicular to the direction of electric current flowing through the finger electrode is represented by  $d_1$ , and an entire length of the edge lines is represented by  $L_1$ , the solar cell elements each include at least one finger electrode where the values  $S_1$ ,  $d_1$ , and  $L_1$  satisfy the following relationship:  $0.5L_1(S_1*d_1^{-1}+d_1)^{-1} > 1.2$ . As the amount of contact surface area between the finger electrodes and semiconductor region is a variable (both dependent upon edge lines and electrode width), that can be modified, among others, by adjusting semiconductor region roughness, with said contact surface area between the finger electrode and semiconductor region increasing as roughness of the semiconductor region is increased, the precise surface roughness would have been considered a result effective variable by one having ordinary skill in the art

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at the time the invention was made. As such, without showing unexpected results, the claimed relationship between finger electrode size and surface roughness cannot be considered critical. Accordingly, one of ordinary skill in the art at the time the invention was made would have optimized, by routine experimentation, the surface roughness in the apparatus of modified Fujii to obtain the desired amount of contact surface area between the finger electrode and semiconductor region (*In re Boesch*, 617 F.2d. 272, 205 USPQ 215 (CCPA 1980)), since it has been held that where the general conditions of the claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. (*In re Aller*, 105 USPQ 223).

### ***Response to Arguments***

7. Applicant's arguments filed August 15, 2011 have been fully considered but they are not persuasive.

Regarding arguments that Hanoka presumably shows an optimized surface electrode, the examiner respectfully disagrees. This is not stated in the reference. Hanoka discloses the number and the widths of the bus bars and fingers are selected so that the area of the front surface exposed to solar radiation is maximized, while at the same time the surface electrode permit recovery of electricity from the cells (C1/L36-56), which presumably means Fig. 2 was optimized for that embodiment only.

Examiner notes that no exhibit was attached with the response, so this was not taken into consideration.



***Conclusion***

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to ALLISON BOURKE whose telephone number is (571)270-1232. The examiner can normally be reached on Monday-Thursday 9am-5pm and every other Friday 9am-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Basia Ridley can be reached on (571) 272-1453. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/A. B./  
Examiner, Art Unit 1725

/Basia Ridley/  
Supervisory Patent Examiner, Art Unit 1725